

Ultrafiltration, chemical and biological oxidation as process combination for the treatment of municipal landfill leachate

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ABSTRACT

A hybrid treatment process was evaluated to reduce the organic load of leachate generated in a former landfill. The leachate, regardless of the time the waste was deposited ("leachate A" has its source in young waste and "leachate B" has its source in old waste), presented high recalcitrance as evidenced by high pH values, salinity (chlorides), COD/BOD₅ ratio and concentration of metals. The fractionation of leachate through filtration using micro- and ultrafiltration membranes revealed that leachate B presented a higher proportion of soluble organic compounds, and its aging led to the decomposition of macromolecules. The ultrafiltration of leachate B with a 20 kDa cut-off membrane to a volume concentration factor of 3.2 and transmembrane pressure close to 1.0 bar resulted in flows of 15 to 20 L.m⁻².h⁻¹ and removal efficiencies of 76% and 79% for COD and color, respectively. The concentrate, when treated with Fenton reagent at pH 4.0, 0.05 mol H₂O₂.L⁻¹ and 200 mg Fe²⁺.L⁻¹, presented its TOC content reduced by 79%. The aerobic biodegradation of the permeate and concentrate after chemical oxidation was evaluated, obtaining TOC removals in 24 h of 29% and 56%, respectively, indicating that even after the retention of a significant fraction of organic matter by the membrane, the leachate still presented compounds difficult to degrade and that the chemical oxidation contributed to the recalcitrance reduction.

Keywords: Landfill leachate treatment; Ultrafiltration; Fenton oxidation, Biodegradation; Hybrid process

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